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L2: Entry 1 of 3

File: USPT

Apr 23, 2002

US-PAT-NO: 6375546

DOCUMENT-IDENTIFIER: US 6375546 B1

TITLE: Method for forming synthetic turf games surface

DATE-ISSUED: April 23, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Lemieux; Alain	Sherbrooke, Quebec			CAX

US-CL-CURRENT: 451/38

ABSTRACT:

A method for forming a synthetic turf game-playing surface comprises, first, providing a pile carpet cover having a base sheet carrying closely spaced-apart, upright, grass-like plastic strands forming simulated grass blades. The cover is laid upon a resilient cushion pad supported upon a firm surface, and sand-like particular material is blasted against the upper portions of the blades at sufficient pressure and for sufficient time to shred the blade upper end portions into fine slivers which remain joined to their respective blades and become intertwined with adjacent slivers to form a dense mat upon the upper surface of the carpet. During the blasting, the resilient cushion beneath the carpet, resiliently supports the upright blades against being crushed or permanently compressed by the force of the blasting.

12 Claims, 6 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 1

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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FORM	Draw Desc	Image
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☐ 2. Document ID: US 6299959 B1

L2: Entry 2 of 3

File: USPT

Oct 9, 2001

US-PAT-NO: 6299959

DOCUMENT-IDENTIFIER: US 6299959 B1

TITLE: Filled synthetic grass

DATE-ISSUED: October 9, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Squires; Troy	Leander	TX		
Cole; L. Alan	Dalton	GA		
Walker; Raymond	Dalton	GA		

US-CL-CURRENT: 428/87; 428/17, 428/331, 428/95

ABSTRACT:

The improved top dressed synthetic turf according to the patent invention provides thatch like fibers to retain top dressing and particularly the rubber or resilient particles in the dressing. The grasslike surface is formed by polyethylene co-polymer slit fibers more than two inches in height tufted through a fiberglass reinforced backing. The thatch zone fibers are dense and texturized so that they will contract to only about one inch in height after curing.

7 Claims, 4 Drawing figures
Exemplary Claim Number: 1
Number of Drawing Sheets: 1

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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☐ 3. Document ID: US 6048282 A

L2: Entry 3 of 3

File: USPT

Apr 11, 2000

US-PAT-NO: 6048282
DOCUMENT-IDENTIFIER: US 6048282 A

TITLE: Line system for playing field

DATE-ISSUED: April 11, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Prevost; Jean	Montreal, Quebec			CAX
Prevost; Jacques J	Montreal, Quebec			CAX

US-CL-CURRENT: 473/490; 273/DIG.13, 428/17

ABSTRACT:

A method of visually marking a line in a natural grass turf playing surface by embedding a synthetic grass strip within the natural turf of football fields and the like. The synthetic strip has a middle band of light colored synthetic grass to mark the line and outer bands of green colored synthetic grass which blend in with the adjacent natural grass. Installation commences with cutting a shallow trench in the turf surface. The synthetic grass turf marking strip is laid into the trench and resilient granular ballast is deposited on the strip backing between upstanding grass-like tufted ribbons. The natural grass adjacent the outer green synthetic ribbons gradually grows into and blends with the outer edges of the outer synthetic green ribbon bands. The outer green colored bands inhibit the lateral spread of natural grass over the light colored middle band. The light colored middle band of synthetic ribbons remains clear of natural grass to mark visually playing field lines in a permanent manner requiring significantly less maintenance than conventional line marking systems.

15 Claims, 5 Drawing figures
Exemplary Claim Number: 1
Number of Drawing Sheets: 4

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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L1: Entry 1 of 1

File: USPT

Sep 28, 1999

US-PAT-NO: 5958527

DOCUMENT-IDENTIFIER: US 5958527 A

TITLE: Process of laying synthetic grass

DATE-ISSUED: September 28, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Prevost; Jean	Montreal			CAX

US-CL-CURRENT: 428/17; 428/212

ABSTRACT:

The invention relates to a synthetic grass turf assembly for installation on a supporting soil substrate to provide a game playing surface that combines the feel of natural turf with the wear resistance of synthetic turf. The turf assembly includes a pile fabric with a flexible sheet backing and rows of upstanding synthetic ribbons representing grass blades, extending upwardly from an upper surface of the backing. A unique infill layer of multiple distinct graded courses of particulate material is disposed interstitially between the upstanding ribbons upon the upper surface of the backing and of a depth less than the length of the ribbons. A base course is first placed upon the top surface of the backing and consists exclusively of hard sand granules. A middle course of intermixed hard sand and resilient rubber granules with relative weight ratio of 3 to 1 is then placed upon the base course. A top course exclusively of resilient rubber granules is then placed upon the middle course. The relatively thin top course that is in contact with users, has a high resilience where contact occurs and low abrasion due to exclusive use of rubber. The base sand course provides weight to hold the turf in place and to quickly drain the surface. The middle layer of mixed sand and rubber granules acts as a buffer to keep the base sand and top rubber courses separate avoiding migration of abrasive sand towards the top surface level. An upper portion of the synthetic ribbons extends upwardly from the top surface of the top course 0.25 to 1.00 inches to give the appearance of grass blades. Preferably the upper portion of the synthetic ribbons is fibrillated, split or frayed on site by passing over the installed surface with a stiff wire brush. The fibrillated surface has a slight resilience and visually appears like a natural grass turf. The criss-crossed fibrillated fibers contain the top course rubber granules while allowing dislodged rubber granules to fall back into place and permitting water to drain through to the sand containing courses.

11 Claims, 2 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 1

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L11: Entry 4 of 250

File: USPT

Jan 15, 2002

US-PAT-NO: 6338885

DOCUMENT-IDENTIFIER: US 6338885 B1

TITLE: Synthetic turf

DATE-ISSUED: January 15, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Prevost; Jean	Cote St-Luc			CAX

US-CL-CURRENT: 428/17; 428/87, 428/95, 473/171, 473/278

ABSTRACT:

A synthetic grass surface comprising widely spaced rows of ribbons and the ribbons having a length about twice as long as the spacing between the rows of ribbons. A particulate material is laid on a matrix of the synthetic grass, and the thickness of the particulate material is as least two-thirds the length of the ribbons. The strips of ribbons are attached by strips of bonding material applied to the back of the matrix or mat. The strips of bonding material are spaced apart and leave areas of mat which are uncoated, thereby providing improved drainage.

21 Claims, 9 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 4

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L11: Entry 5 of 250

File: USPT

Jan 1, 2002

US-PAT-NO: 6334275

DOCUMENT-IDENTIFIER: US 6334275 B1

TITLE: Sports surfaces and methods of preparing sports surfaces comprising a transportable turf grass

DATE-ISSUED: January 1, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Egan; Michael A.	Savannah	GA		

US-CL-CURRENT: 47/56

ABSTRACT:

The present invention is directed to methods of preparing a sports surface comprising a transportable turf grass. A sand based root zone medium is employed for the production of the transportable turf grass on a barrier at a place other than the sports site. The present invention is also directed to the sports surfaces made by the methods of the present invention.

27 Claims, 1 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 1

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L11: Entry 14 of 250

File: USPT

Oct 2, 2001

US-PAT-NO: 6295756

DOCUMENT-IDENTIFIER: US 6295756 B1

TITLE: Surface for sports and other uses

DATE-ISSUED: October 2, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bergevin; Jerry G.	Edmonds	WA		

US-CL-CURRENT: 47/1.01R

ABSTRACT:

An improved playing surface including a synthetic turf base positioned atop a foundation. The synthetic turf base includes synthetic fibers secured to a backing material. The synthetic turf base also includes a surface layer of growth medium applied on top of the backing material to reach a predetermined depth. Natural grass is planted in the surface layer of growth medium. The backing is provided with perforations or openings sufficient in number to permit the roots of the natural grass to extend through the backing into the sub-base of the foundation.

26 Claims, 16 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 8

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L11: Entry 19 of 250

File: USPT

Jun 5, 2001

US-PAT-NO: 6242062

DOCUMENT-IDENTIFIER: US 6242062 B1

TITLE: Combined turf

DATE-ISSUED: June 5, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
de Vries; Hugo	Ridderkerk			NLX

US-CL-CURRENT: 428/17; 139/391, 139/392, 405/36, 405/38, 428/85, 428/95, 47/56

ABSTRACT:

The invention relates to a base layer for a combined synthetic and natural turf comprising a fabric of which at least a part of the weft and/or warp threads is manufactured from a biodegradable material and/or is wholly absent so that the fabric contains apertures, and synthetic turf fibers which are least partially cowoven with the fabric and of which one or both ends form synthetic grass blades. These ends only protrude from the fabric at those locations where the non-degradable warp and weft threads intersect. The base layer is used in combined synthetic and natural turfs comprising a foundation, optionally a first layer of growth substrate and a base layer according to the invention which is provided with a second layer of growth substrate in which grass plants grow. The invention further relates to a method for laying a combined turf using the base layer of the invention.

30 Claims, 4 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 4

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L11: Entry 22 of 250

File: USPT

Apr 17, 2001

US-PAT-NO: 6216389

DOCUMENT-IDENTIFIER: US 6216389 B1

TITLE: Stabilized natural turf with decomposition agent

DATE-ISSUED: April 17, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Motz; Joseph E.	Cincinnati	OH		
Heinlein; Mark A.	Cincinnati	OH		

US-CL-CURRENT: 47/58.1R, 428/17, 428/85, 428/92, 428/95, 47/1.01R, 47/56, 47/9

ABSTRACT:

A stabilized natural turf surface particularly suitable for athletic fields includes a mat interposed between upper and lower layers of growth media, the mat having a woven biodegradable backing and upwardly extending artificial fibers secured thereto, wherein the fibers extend well above the top of the upper layer. Natural grass plants grow in the upper layer, with the crowns being located in the upper layer of growth media and the roots extending down through the backing and into the lower layer. The mat helps to stabilize root growth, particularly during the first few years. The biodegradability of the backing results in its eventual decomposition, so that after a predetermined time the turf surface may be aerated all the way down to the lower layer without adversely affecting the mat and the mat can be top dressed beginning immediately after turf growth occurs. The biodegradability also prevents the creation of an agronomic barrier between the upper and lower layers.

32 Claims, 1 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 1

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L11: Entry 25 of 250

File: USPT

Jan 16, 2001

US-PAT-NO: 6173528

DOCUMENT-IDENTIFIER: US 6173528 B1

TITLE: Stabilized natural turf for athletic field

DATE-ISSUED: January 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Motz; Joseph E.	Cincinnati	OH		
Heinlein; Mark A.	Cincinnati	OH		

US-CL-CURRENT: 47/58.1R; 405/302.4, 405/302.7, 428/17, 428/85, 428/92, 428/95,
47/1.01R, 47/56, 47/9

ABSTRACT:

A stabilized natural turf surface particularly suitable for athletic fields includes a mat interposed between upper and lower layers of growth media, the mat having a woven biodegradable backing and upwardly extending artificial fibers secured thereto, wherein the fibers extend well above the top of the upper layer. Natural grass plants grow in the upper layer, with the crowns being located in the upper layer of growth media and the roots extending down through the backing and into the lower layer. The mat helps to stabilize root growth, particularly during the first few years. The biodegradability of the backing results in its eventual decomposition, so that after a predetermined time the turf surface may be aerated all the way down to the lower layer without adversely affecting the mat and the mat can be top dressed beginning immediately after turf growth occurs. The biodegradability also prevents the creation of an agronomic barrier between the upper and lower layers.

31 Claims, 1 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 1

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L11: Entry 30 of 250

File: USPT

Nov 14, 2000

US-PAT-NO: 6145248

DOCUMENT-IDENTIFIER: US 6145248 A

TITLE: Sports playing surfaces with biodegradable backings

DATE-ISSUED: November 14, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bergevin; Jerry G.	Edmonds	WA		

US-CL-CURRENT: 47/58.1R; 19/144, 423/447.1, 47/65.5

ABSTRACT:

A biodegradable playing surface (100) including a synthetic turf base (104) positioned atop a foundation (102) is provided. The synthetic turf base includes an at least partially biodegradable backing (112) having a plurality of openings (116), and synthetic fibers (110) secured to the biodegradable backing. The synthetic turf base also includes a surface layer of growth medium (118) applied on top of the biodegradable backing to reach a predetermined depth. Natural grass (120) is planted in the surface layer of growth medium. The biodegradable backing degrades over time so as to increase the size and number of the openings through the backing. This allows the roots of the natural grass to increasingly grow amongst the synthetic fibers and through the backing, so as to firmly integrate the synthetic turf base to the foundation.

15 Claims, 18 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 9

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L11: Entry 53 of 250

File: USPT

Oct 5, 1999

DOCUMENT-IDENTIFIER: US 5961389 A
TITLE: Sport and recreational surface

Abstract Paragraph Left (1):

A recreational and sport surface which contains a particulate composition containing an intimate mixture of sand, polyolefin fibers, polyolefin particles, tire fibers and a coating of wax on the ingredients of the composition. The surface is preferably placed over a crushed aggregate layer which provides drainage to an area and may also contain a separator layer to prevent the passage of particulate material from the composition.

Brief Summary Paragraph Right (2):

The present invention relates to a loose, particulate mixture which can be applied over an easily drained underlayer to provide an outstanding sport and recreational surface. More specifically, the invention provides running, walking and jumping surfaces particularly suited for use in racetracks, exercise areas, and equestrian performance or training rings for horses and ponies. The present invention can also be used in jogging trails, paths and running areas for humans, dogs, automobiles, motorcycles and the like.

Brief Summary Paragraph Right (5):

U.S. Pat. No. 4,501,420 to Dury, which is hereby incorporated in its entirety by reference, discloses a method of making a sport surface by laying at least one flexible, water-permeable material containing sand on a water-permeable surface and placing a sheet or resilient material on top of it.

Brief Summary Paragraph Right (6):

U.S. Pat. No. 4,819,933 to Armond, which is hereby incorporated in its entirety by reference, discloses a sport surface comprising a layer of sand mixed with less than 1.0% by weight of long synthetic fibers, which is laid on top of a prepared drainage base. The Armond surface requires copious amounts of water on a frequent basis in order to prevent the surface from drying out and becoming hard and non-resilient.

Brief Summary Paragraph Right (7):

U.S. Pat. No. 5,014,462 to Malmgren et al., which is hereby incorporated in its entirety by reference, discloses a method of preparing soil to improve its porosity and reduce it from being compacted. The method comprises loosening the top layer of soil and mixing at least about 10% by volume of solid rubber particles and grass seed into the soil layer.

Brief Summary Paragraph Right (8):

U.S. Pat. No. 5,041,320 to Meredith et al., which is hereby incorporated in its entirety by reference, teaches a sport surface which comprises a pile fabric and a layer of rubber coated mineral grains (e.g., sand) in which the pile is partly submerged.

Brief Summary Paragraph Right (10):

Notwithstanding the aforementioned advancements in sport surfacing, there remains a need for a sport and recreational surface which is stable, water-resistant, easily drained, easily and inexpensively manufactured, resistant to compaction, and hard enough to provide resistance, yet resilient enough to also provide a cushion.

Brief Summary Paragraph Right (11):

Accordingly, it is an object of the present invention to provide a sport and recreational surface which improves over the prior art surfacing compositions.

Brief Summary Paragraph Right (12):

It is a further object of the present invention to provide a sport surface which is resistant to compaction and water retention such as to increase the availability of the surface to be safely used by athletes and horses.

Brief Summary Paragraph Right (13):

It is yet another object of the present invention to provide a sport surface having good shock absorption.

Brief Summary Paragraph Right (14):

It is still another object of the present invention to provide a sport surface which can be easily and inexpensively prepared and maintained, and which has a longer service life than conventional artificial surfaces.

Brief Summary Paragraph Right (15):

It is yet a further object of the present invention to provide a sport surface which utilizes environmentally friendly materials, such as scrap rubber tire parts.

Brief Summary Paragraph Right (17):

It is still another object of the present invention to provide a sport surface which may be prepared over a variety of surfaces including cement, dirt, clay, turf and the like.

Brief Summary Paragraph Right (19):

The present invention provides an environmentally safe, non-toxic, and non-irritating sport and recreational surface. More particularly, the present invention creates an ideal equestrian footing which reduces shock and provides cushioning to the feet of running and jumping horses, while still providing sufficient resistance to their rear legs so that they may increase and maintain their speed. The surface is stable, non-slip, dust-resistant, water-resistant and easily drained. Unlike natural track surfaces, the compositions of the present invention require minimal irrigation, thereby reducing the cost of water, machinery and manpower resources. Furthermore, the surface requires relatively little maintenance such as grading and harrowing. Moreover, the surface disclosed herein will be available for use more often than conventional surfaces during the rainy season. Also, the excellent drainage properties reduce the likelihood of injuries to athletes or animals who run on the surface.

Brief Summary Paragraph Right (20):

The ingredients employed in the compositions of the instant invention are low cost, natural (e.g., sand) and/or synthetic (e.g., polymeric) materials. A major part of preferred compositions comprise recycled plastic such as casings from wire and cable, and from automobile and truck tires. Thus, the invention not only provides an outstanding surface for sport and recreational uses, but also supplies an outlet for recycled plastic products that might otherwise pollute the environment and/or overburden the landfills.

Brief Summary Paragraph Right (21):

The present invention comprises sand, a hydrocarbon wax and at least one material selected from one or more of the following three classes of ingredients: (i) polyolefin fibers, polyvinyl chloride fibers, wood or a mixture thereof, (ii) polyolefin particles; and (iii) tire fibers, tire cord or a mixture thereof. According to a preferred embodiment, sand, chopped fibers of synthetic polymers, plastic polymer particles and tire fibers or cord are intimately mixed, essentially in a dry state, and substantially uniformly coated with a thin film of hydrocarbon wax. Preferably, the synthetic polymers include low and high density polypropylene and the plastic polymer particles include low and high density polyethylene. The ingredients are essentially dry and may be mixed in any suitable manner consistent with the amount of surface material desired such as in a blacktop plant, a cement mixer, or a cattle feed mixer. The specific ingredients are chosen such that the final composition is weather resistant and long lasting, and resistant to degradation when exposed to the conditions of normal outdoor use.

Brief Summary Paragraph Right (23):

The present invention preferably comprises a particulate composition for use as a sport or recreational surface comprising:

Brief Summary Paragraph Right (24):

Sand, polyolefin fiber, polyolefin particles and tire fiber are added and mixed together in a mixer. All of the ingredients are essentially dry solids. The intimate dry mixture is then mixed with a suitable hydrocarbon wax such as paraffin wax or a

mixture of waxes. These waxes are readily available from a variety of commercial sources. They usually comprise high molecular weight materials and are preferably mineral waxes derived from petroleum by-products, for example, dewaxing light lubricating oil stocks (e.g., paraffin waxes). The wax is first heated to liquify it and the melted wax is coated in a substantially uniform layer over each ingredient. The coating is typically achieved by spraying the melted wax over the essentially dry mixture as it is being stirred or tumbled in a suitable mixer, for example, in the same mixer used initially to intimately mix the essentially dry ingredients.

Brief Summary Paragraph Right (25):

The wax can be of any suitable nature provided that it has a sufficiently high enough melting point. The wax is chosen to have a relatively high melting point such that it does not melt or soften to any substantial extent during use, keeping in mind that under summer conditions the sport or recreational surface may reach temperatures well in excess of 100.degree. F. Accordingly, the melting point of the wax should be in excess of 120.degree. F. and under some circumstances above 170.degree. F. Generally, most waxes do not have a sharply defined melting point, but rather, melt over a range of 10 to 30.degree. F. In any event, the melting point must be sufficiently high such that the sport or recreational surface will not become sticky and the particulate material will not unduly clump and/or stick together when cooled. The wax coating serves to seal and protect the particulate materials from environmental influences and to impart a degree of slip so that the desired cushioning is achieved when initially cooled after coating. The coated particulate material of this invention may solidify into lumps or clumps, but these solids are easily broken up by hand or with a powered mixer. Once broken up, the finished mixture will retain its particulate nature.

Brief Summary Paragraph Right (26):

The compositions of the present invention are advantageously laid down on the ground over a layer of material that will provide good drainage. While the surface may be laid over practically any type of surface, for example, cement, dirt, clay and turf, it is preferable to lay it over cement or dirt to maximize the drainage benefits of the present invention. Most preferably, it is laid over cement. In use, rain or irrigation water will quickly penetrate and drain through the composition. This is a necessary characteristic, and to be certain that the water will completely drain through the mixture, an aggregate layer or other underlayment of, for example, crushed or broken gravel, stone, or other aggregate (e.g., quarry, granite or limestone fines or dust), or a mixture thereof, is desired. To provide enhanced drainage functions, the underlayer should have a depth of about 3-4 inches and be full of 1-4 inches of aggregate, such as crushed washed stone which is 1/4 to 2 inches in diameter. Most preferably, the underlayer will be at least 6 inches deep and contain at least 4 inches of crushed washed stone. Advantageously, a pipe will be laid down with the crushed stone to facilitate rapid egress of any water. The size and uniformity of the drainage underlayer are not critical so long as drainage is accomplished and the particulate mixture of the invention does not significantly penetrate the drainage layer.

Brief Summary Paragraph Right (27):

The drainage underlayer preferably occupies the same linear dimensions in width and length as the sport surface. However, it is contemplated that the underlayer may be longer, shorter, wider, or thinner than the sport surface so long as the function of drainage is not significantly compromised. The composition is ideally spread over the drainage underlayer to a suitable depth of at least 4 inches, and preferably at least 5 to 6 inches. The thickness may be increased beyond these limits, but considerations of increased cost versus diminution of enhanced benefits impose practical limits on thickness. The compositions of the present invention can be used for long periods of time, for example, up to about 4 to 5 years, but eventually they will break down and require replacement or refurbishing. Usually, the wax, and not the particulate materials, degrade and the original particles can simply be recoated with wax in a suitable mixing device.

Brief Summary Paragraph Right (28):

Preferably, a water-permeable separator layer, such as a suitable textile, net mesh, other porous membrane layer, or a mixture thereof will be interposed between the sport surface and the drainage layer. The separator layer may be natural or synthetic. In a preferred embodiment of the present invention, a metal screen or a Geotextile membrane separates the particulate materials of the invention, especially the sand, from the drainage materials (e.g., crushed stone). Covering the crushed stone with a porous membrane will prevent the intermixing of the surface layer with the drainage area. Without a separator layer, the sand content of the surface layer may ultimately leach into the crushed stone, thereby reducing drainage and modifying the composition of the

surface layer, or at least that portion which is closest to the crushed stone. Suitable separator materials are chosen based on the particle size of the surface composition, its durability and its resistance to deterioration. Any material is satisfactory so long as it allows water to pass through it, while blocking the passage of any particulate matter.

Brief Summary Paragraph Right (31):

The polyolefin fibers which are useful in the practice of this invention comprise a variety of chopped and/or cut synthetic fibers of, for example, low carbon chain high and/or low density polyolefins such as polyethylene, polypropylene and/or copolymers thereof. These fibers are commercially available from a variety of sources. They may be straight or curly and typically range in length from about 1/4 to 2 inches, preferably 1/2 to 1 1/2 inches, and range in thickness from about 1/24 to 1/4 inches, preferably 1/16 to 1/8 inches. One such useful fiber is sold under the designation Sport Grids.RTM. (see Example 1) and another type (available from the same company) is available under the trade name Turf Grids.RTM.. Optionally, other suitable fibers may also be used in lieu of or in combination with the polyolefin fibers and their selection is commonly dependent upon cost and availability, such as wood and polyvinylchloride fibers.

Brief Summary Paragraph Right (32):

The polyolefin particles used in the present invention advantageously include low carbon chain polyolefins such as high and/or low density polyethylene, polypropylene, and/or copolymers thereof. These particles are typically derived from recycled or scrap plastics which are ground, chopped or otherwise cut into thin coarse particles which range in length from approximately 1/2 to 1 inches, preferably 5/8 to 7/8 inches, and most preferably 3/4 inch. The thin particles are about 1/32 to 1/16 inches thick. The narrowness of these particles is critical and unexpectedly contributes to superior cushion and drainage characteristics to the sport surface. One preferred source of such particles is casings from recycled wire or cable, where the protective casing is separated from the metal wire or cable and then converted into the appropriate particle size. These particles contribute improved resilience and drainage and can be further used to control the color or the sport surface. Using recycled or scrap materials also serves the purpose of manufacturing an environmental friendly product.

Brief Summary Paragraph Right (33):

The tire fibers and/or cord used in the present invention typically comprise non-metallic reinforcing fibers and/or cord which are readily obtained from the recycling of truck or automobile tires. The fibers and/or cord, which may be made from synthetic or natural materials, are cut to suitable lengths of between about 1/4 to 2 1/2 inches, preferably 1/2 to 1 1/2 inches, and may have small pieces of tire rubber (vulcanized rubber), other elastomeric materials and/or fabric still attached. The tire fibers and/or cord are light-weight, long lasting and soft, which improve the resiliency and the drainage characteristics of the surface. Furthermore, like with the polyolefin particles, using recycled or scrap tire materials promotes the environment.

Brief Summary Paragraph Right (34):

The present invention further contemplates the use of one or more auxilliary ingredients, where convenient and as needed, such as ash, silt, clay, fillers, natural fibers, odorants, colorants, cord derived from sources other than tires and other suitable elastomeric materials. These auxilliaries may be used in amounts of up to 50 percent by weight, based on the total weight of the composition. The final product is strong, stable, and inert to biological degradation and naturally occurring chemicals, alkalis and acids.

Brief Summary Paragraph Type 1 (3):

C. about 5-50 percent by weight of one or more of the following ingredients: a fiber, wood, particle, and/or cord, for example, one or more ingredients selected from one or more of the following three classes of ingredients: (i) about 3-15 percent by weight of polyolefin fibers, polyvinyl chloride fibers, wood, or a mixture thereof, (ii) about 7.5-22.5 percent by weight of polyolefin particles, and (iii) about 7.5-22.5 percent by weight of tire fibers, tire cord, or a mixture thereof. Preferably, a mixture of materials from two classes of ingredients of item C are used. Most preferably, materials from all three classes of ingredients of item C are utilized.

Brief Summary Paragraph Table (1):

Percent by Ingredients	Weight	Weight	Weight	Preferred Most Preferred Percent by Percent
40-65	48-56	51-53	Chopped	3-15 5-10 7-8 <u>Polyolefin</u> Fiber <u>Polyolefin</u> 7.5-22.5 12-18

14-16 Particle Non-metallic/tire 7.5-22.5 12-18 14-16 Fiber Petroleum Wax 5-17.5 8-12
9-11

Detailed Description Paragraph Right (1):

The composition of this example is prepared from the following ingredients to provide the following percents by weight in the final particulate product:

Detailed Description Paragraph Right (3):

The polypropylene fibers used in this example are obtained from Stabilizer, Inc., Phoenix, Ariz., under the trade name Sport Grids.RTM.. These fibers are essentially uniform fibers of polypropylene of about 1/2 to 1 1/4 inches in length and about 1/16 to 1/8 inches in thickness.

Detailed Description Paragraph Right (4):

The polyethylene particles used in this example are particulate plastic casings from recycled wiring, with the wire removed. The polyethylene casing is ground to a particle size of approximately 3/4 inch long and 1/24 inch thick.

Detailed Description Paragraph Right (6):

The sand, polypropylene fibers, polyethylene particles and tire fibers are thoroughly mixed together to form an intimate and essentially uniform mixture of essentially dry ingredients.

Detailed Description Paragraph Right (7):

The petroleum hydrocarbon wax used in this example is heated and melted to above 200.degree. F. The melted (liquified) wax is then intimately mixed with the remaining ingredients to coat them. The wax is characterized as a paraffin wax derived from petroleum by-products. It is dark brown to black in color, has a specific gravity of 0.86, essentially no volatiles, a melting point of 130-155.degree. F. and is insoluble in water. Mixing is continued until essentially all of the particulate ingredients are covered with a thin wax coating.

Detailed Description Paragraph Right (8):

The mixture is then cooled while mixing, and the wax is allowed to solidify. When cooled, some of the particulate materials may stick together, but they are easily broken up into smaller particulates either by hand or mechanically. The resulting mixture is then deposited over a bed of crushed stone which is approximately 6 inches in thickness (for drainage purposes). The mixture is applied to form a substantially uniform layer having a thickness of about 5 to 6 inches. Thus, the whole sport surface (top layer over crushed stone layer) is about 10 to 13 inches thick. Before depositing the mixture of the invention over the crushed stone, a textile separator (e.g., Geotextile) is advantageously placed over the stone to keep the sand and other particulate material from filtering down into the stone area.

Detailed Description Paragraph Table (1):

	Ingredients	Percent by Weight
	Sand	52.0
	Polypropylene fibers	7.5
	<u>Polyethylene</u>	
	particles	15.0
	Tire fibers	15.0
	Petroleum wax	10.5

CLAIMS:

1. A particulate composition for use as a sport or recreational surface comprising:

A. about 40-86 percent by weight of sand,

B. about 5-20 percent by weight of a hydrocarbon wax, and

C. about 5-50 percent by weight of a fiber, wood, particle, and/or cord selected from the group consisting of: (i) about 3-15 percent by weight of a polyolefin fiber, a polyvinyl chloride fiber, wood, or a mixture thereof, (ii) about 7.5-22.5 percent by weight of a polyolefin particle, (iii) about 7.5-22.5 percent by weight of a tire fiber, a tire cord, or a mixture thereof, and (iv) a mixture of components (i) and (ii), (ii) and (iii), (i) and (ii), or (i), (ii) and (iii), the percent by weight of each ingredient being based on the total weight of the composition.

3. A sport or recreational surface comprising at least about a 4 inch layer of the composition of claim 1, which is substantially and uniformly spread over an underlayer capable of drawing water away from the composition.

7. The composition of claim 1, wherein the polyolefin fiber is a chopped and/or cut synthetic polyethylene fiber, a polypropylene fiber, a copolymer of a polyethylene or polypropylene fiber, or a mixture thereof.

8. The composition of claim 1, wherein the polyolefin particle is a polyethylene particle, a polypropylene particle, a copolymer of polyethylene or polypropylene particle, or a mixture thereof.

9. The composition of claim 8, wherein the polyolefin particle is prepared from a recycled or scrap plastic.

10. The composition of claim 1, wherein the polyolefin particle is about 1/2 to 1 inch long and 1/32 to 1/16 inch thick.

13. A particulate composition for use as a sport or recreational surface comprising about 40-65 percent by weight of sand, about 3-15 percent by weight of a polyolefin fiber, optionally the polyolefin fiber being partly or wholly replaced by a polyvinyl chloride fiber or wood, about 7.5-22.5 percent by weight of a polyolefin particle, about 7.5-22.5 percent by weight of a tire fiber or cord, and about 5-17.5 percent by weight of a hydrocarbon wax, the wax being present in a form of a substantially uniform and thin coating on the ingredients of the composition, the percent by weight of each ingredient being based on the total weight of the composition.

14. A sport or recreational surface comprising at least about a 4 inch layer of the composition of claim 13, which is substantially and uniformly spread over an underlayer capable of drawing water away from the composition.

16. The composition of claim 13, wherein the ingredients are present in the following approximate percents by weight, based on the total weight of the composition:

Ingredients Percent by Weight			
	Sand 48-56	<u>Polyolefin</u> fibers 5-10	<u>Polyolefin</u>
<u>Particles</u> 12-18	Tire Fibers 12-18	Wax 8-12	

17. A method of making a sport or recreational surface, the method comprising the steps of:

(a) admixing about 40-86 percent by weight of sand and at least one of: (i) about 3-15 percent by weight of a polyolefin fiber, a polyolefin chloride fiber, wood or a mixture thereof, (ii) about 7.5-22.5 percent by weight of a polyolefin particle, and (iii) about 7.5-22.5 percent by weight of a tire fiber, a tire cord, or a mixture of the tire fiber and cord;

(b) heating about 5-20 percent by weight of a hydrocarbon wax until the wax has liquified;

(c) admixing the liquid wax into the mixture of step (a) to form a wax coated particulate composition, the percent by weight of each ingredient being based on the total weight of the composition;

(d) cooling the particulate composition of step (c);

(e) optionally, breaking up the particulate composition into smaller particulates by hand or mechanically; and

(f) depositing the cooled composition of steps (d) or (e) over an underlayer which is capable of drawing water away from an area.

20. A sport or recreational surface prepared according to the method of claim 17.

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File: USPT

Dec 22, 1998

DOCUMENT-IDENTIFIER: US 5850708 A
TITLE: Surface for sports and other uses

Abstract Paragraph Left (1):

An improved playing surface including a synthetic turf base positioned atop a foundation. The synthetic turf base includes synthetic grass fibers secured to a backing material. The synthetic turf base also includes a surface layer of growth medium intermixed with the synthetic grass fibers. Natural grass is planted in the surface layer of growth medium wherein the natural grass includes natural grass blades and roots. The backing is provided with perforations or openings sufficient in number to permit the roots of the natural grass to extend through the backing into the sub-base of the foundation. The improved playing surface may include synthetic grass fibers of varying lengths, longer synthetic grass fibers can be formed of contrasting colors in order to provide line and boundary indicators. A mesh-type material is placed underneath the adjoining layers of backing material in order to reinforce the interface between separate sections of backing material.

Parent Case Paragraph Right (1):

This is a continuation-in-part of U.S. patent application Ser. No. 08/334,414, filed Nov. 4, 1994, by Jerry G. Bergevin, entitled IMPROVED SURFACE FOR SPORTS AND OTHER USES, now U.S. Pat. No. 5,586,408, which is a continuation of U.S. patent application Ser. No. 08/078,624, filed Jun. 17, 1993, now abandoned, which is a continuation-in-part of U.S. patent application Ser. No. 07/902,147, filed Jun. 22, 1992, now abandoned, the disclosure of which is incorporated herein, in its entirety, by the foregoing reference thereto.

Brief Summary Paragraph Right (1):

The present invention is directed toward an improved surface for sports and other uses and, more particularly, toward a combination artificial and natural surface and method of making the same.

Brief Summary Paragraph Right (2):

For years natural turf surfaces were used for most outdoor sports, for example, soccer, football, field hockey, cricket, rugby, etc. Natural turf surfaces are surfaces constructed with a grass grown in soil, or some other surface layer of material (e.g., sand and organic mixes, etc.), that is constructed upon a suitable foundation. A natural turf surface is generally preferred for its comfort, feel, grip, and appearance.

Brief Summary Paragraph Right (3):

However, under heavy use and/or poor weather conditions, natural turf surfaces deteriorate rapidly and maintenance is costly. Intense activity on the turf destroys the grass and its root system, leaving mud and/or dirt as the playing surface. During this time, prior to re-establishment, the surface is often pockmarked, uneven, and possibly even hazardous to use.

Brief Summary Paragraph Right (4):

Another problem associated with natural turf surfaces is the use of painted on yardage and boundary lines. Typically, such boundary lines are formed by painting the playing surface. For aesthetic reasons, such lines are generally painted just prior to each official game played on the playing surface. The repeated application of paint to the surface of the playing surface tends to kill the grass that is located under the painted surface. In addition, over time the multiple layers of paint build up forming a surface that is substantially harder than the surrounding natural grass playing surface. Thus, the painted areas of the playing surface can create slippery spots within the playing surface, possibly leading to slips and falls by athletes using the

playing surface. In addition, the painted areas can increase the possibility of injury to the athlete and create hard spots that can be uncomfortable or painful to an athlete that falls upon the painted area.

Brief Summary Paragraph Right (5):

Due to the needs of sports programs, play usually continues on the playing surface, even when the surface is badly damaged, until the sport's season is over, when the turf can be re-established. Thus, the playing conditions on the playing surface continually decline over the season. At the end of the season, the natural turf surfaces are reseeded, the divots leveled and filled, etc. The natural turf surfaces are not usable during this re-establishment period because use defeats the re-establishment of the turf. The re-establishment period typically takes at least four months, or longer, under ideal weather conditions, during which the natural turf surface should not be used.

Brief Summary Paragraph Right (6):

Recently, synthetic turf surfaces have been used as an alternative to natural turf surfaces. Synthetic turf surfaces generally come in two types, i.e., conventional and sand filled. Conventional synthetic turf is a dense synthetic material that has the appearance of dense grass blades but is manually placed indoors or outdoors, usually upon an asphalt, concrete, wood, or other foundation. Sand-filled synthetic turf is a synthetic material similar to conventional synthetic turf, but with greater spacing between the blades, to accommodate a silica sand filling.

Brief Summary Paragraph Right (7):

Both the conventional and sand-filled synthetic turf are placed indoors or outdoors, upon a foundation that may include an asphalt, concrete, wood or other supporting subsurface along with cushioning mats, water drainage and water irrigation.

Brief Summary Paragraph Right (8):

Although synthetic turf surfaces are more durable and consistent than well-established natural turf surfaces, they are regarded as only moderately successful for sports and other uses. The most notable disadvantage of synthetic turf surfaces is the discomfort for the players and an increased number of injuries. Additionally, synthetic turf surfaces are generally expensive to put in place and have a life expectancy of 8-15 years, if properly maintained, and for less if poorly maintained. Outdoor synthetic turf surfaces also remove large areas from the ecosystem, reducing natural processes including ground water recharge, oxygen and carbon monoxide balance, temperature modulation, and dust filtration. For these and other reasons, a number of synthetic turf surfaces are currently being converted back to the natural turf surfaces.

Brief Summary Paragraph Right (9):

As can be seen from the above discussion, there exists a need for an improved surface for sports and other uses, and a method of making the improved surface, wherein the surface provides improved comfort and fewer injuries to the users, while being durable under heavy use and in poor weather conditions. The present invention is directed toward fulfilling this need.

Brief Summary Paragraph Right (10):

The present invention provides an improved surface for sports fields and for other high traffic uses. In one embodiment, the surface includes a foundation and a growth medium filled synthetic turf positioned atop the foundation. The synthetic turf base includes synthetic grass fibers attached to a permeable backing material with a layer of growing medium filled between the synthetic grass fibers. The synthetic grass fibers are constructed of a flexible, synthetic material and extend generally vertically upward from the backing material.

Brief Summary Paragraph Right (11):

In one embodiment, the playing surface includes a foundation and a synthetic grass turf located on top of the foundation. The synthetic grass turf includes a backing material and a plurality of synthetic grass fibers extending generally vertically upward from the backing material. The synthetic grass fibers are formed of at least a first group of fibers having a first length and a second group of fibers having a second length that is longer than the first length so that the second group of fibers extend upward from the backing material a greater distance than the first group of fibers. A layer of growth medium is disposed in the synthetic grass turf to a depth sufficient to substantially fill the synthetic grass turf to the top of the first group of fibers. Grass is planted in the growth medium so that the roots grow downward through the growth medium, through the backing material, and into the foundation. The blades of the

grass grow upward from the top of the growth medium to form a playing surface.

Brief Summary Paragraph Right (12):

In accordance with other aspects of the invention, the second group of fibers are uniformly interspersed throughout the playing surface. The second group of fibers extend upward and are intertwined with the natural grass blades. The first group of fibers protect the crowns of the grass plants, while the second group of fibers help to protect the blades of the grass plants.

Brief Summary Paragraph Right (13):

In accordance with other features of the invention, the second group of fibers are formed of a color that contrasts with the grass and provides a visual indicator. The second group of fibers are placed in an organized pattern to provide boundary indicators, line indicators, etc. The backing material in the region of the second group of fibers is formed of a material that is root-impervious. The backing material also includes a herbicide to prevent natural grass plants from growing into and through the backing material in the region of the second group of fibers.

Brief Summary Paragraph Right (14):

In accordance with other aspects of the invention, the backing material is formed of a woven material. The woven material is provided some in-plane stability through the use of fusing the strands of the woven material along the edges of the synthetic grass turf.

Brief Summary Paragraph Right (15):

In accordance with yet other aspects of the invention, a mesh material is placed beneath the foundation and the synthetic grass turf. The mesh material is located in the region of adjoining edges of the synthetic grass turf and underlies the adjoining edges of the synthetic grass turf. The roots of the grass plants grow through the synthetic grass turf, through the mesh material, and into the foundation, thus binding different pieces of the synthetic grass turf to the mesh material and the foundation. The mesh material can include protrusions extending from either one or both sides of the mesh material. The protrusions extend into the foundation and into the backing material in order to help anchor the edges of the synthetic grass turf.

Brief Summary Paragraph Right (16):

The playing surface of the present invention improves the durability and visual appearance of natural grass playing surfaces. The playing surface of the invention helps to protect the crowns of the natural grass plants, thus helping to prevent damage to the natural grass. This allows the present invention to produce a playing surface that recovers more quickly than natural grass playing surfaces. However, the playing surface of the present invention is formed substantially of natural grass blades thus providing the comfort and appearance of a natural grass playing surface. The playing surface of the invention can also be formed with built-in visual indicators such as boundary or line indicators. Such line indicators do not have the disadvantages of prior painted-on line indicators.

Drawing Description Paragraph Right (8):

FIGS. 5A and 5B are more detailed illustrations of one embodiment of a synthetic grass fiber used in the invention;

Detailed Description Paragraph Right (5):

The present invention is intended, among other uses, for use as a sports playing field, in which case a sub-base 108 atop the sub-grade 106 will most likely be desired to insure adequate support, and drainage to the improved surface 100. However, as will become apparent to those skilled in the art, the present invention is also suitable for use as other surfaces, such as, for example, fire access and parking medians, home yards, parks, and virtually anywhere that a natural or artificial turf surface is desired. In such applications, the sub-grade 106 and sub-base 108 may be modified to suit the particular use to which the invention is being put. Further, in some applications, it may be desirable to eliminate the sub-base 108 altogether. However, it is generally desirable to provide some sub-base 108 (or alternatively, a modified sub-grade 106) upon which the synthetic turf base 104 can be supported.

Detailed Description Paragraph Right (6):

The synthetic turf base 104 includes a multiplicity of synthetic grass fibers 110 that are tufted, or otherwise secured, to a flexible, porous backing 112. The synthetic grass fibers 110 are constructed of a synthetic material that is substantially flexible. The synthetic grass fibers 110 each extend generally upward from one side of

the flexible backing 112 and are generally perpendicular to the flexible backing 112. The synthetic grass fibers 110 are of sufficient length that the top portions 114 are spaced upward from the flexible backing 112. As discussed in more detail below, the flexible backing 112 includes a plurality of openings 116 (an example of a perforated backing is shown more clearly in FIGS. 3A and 3B, alternatively where backing may be woven sufficiently coarse that the voids between the strands that form the backing form sufficient openings) that permit water drainage through the backing and into the foundation 102.

Detailed Description Paragraph Right (7):

The synthetic turf base 104 may be readily constructed by those skilled in the art. Generally, synthetic turf constructions that are used with sand-filled synthetic turf surfaces are suited for use as the synthetic turf base 104 of the present invention. However, it is preferable that the backing material have sufficient openings and that the density of the synthetic fibers be such to allow a dense growth of natural grass throughout the surface.

Detailed Description Paragraph Right (8):

Preferably, the synthetic grass fibers 110 of the synthetic turf base 104 are partially slit, as illustrated in FIG. 5B, or "fibrillated," i.e., include several blade openings 508 through each synthetic grass fiber from the top portions 114 to the flexible backing 112. The openings 508 in the synthetic grass fibers 110 and the backing openings 116 in the flexible backing assist in binding the resulting improved surface 100 together as will be described in more detail below.

Detailed Description Paragraph Right (9):

The flexible backing 112 is provided for positioning the synthetic grass blades 110 during installation and maintaining the synthetic grass blades 110 in position during use of the improved surface 100. Further, the flexible backing 112 provides structural support to the improved surface 100 by distributing the force of impact upon the improved surface, thereby substantially preventing compaction of the sub-base 108.

Detailed Description Paragraph Right (10):

In the preferred embodiment of the invention, the synthetic grass fibers 110 are tufted to a flexible backing 112 that is constructed from a woven fabric. The backing 112 is provided for receiving the synthetic grass fibers 110 to hold the synthetic grass fibers in relative position during installation and thereafter.

Detailed Description Paragraph Right (11):

In the preferred embodiment of the invention, the backing 112 is a mesh having the synthetic grass fibers 110 tufted into the backing. The backing may be formed of a nonbiodegradable material or may be partially or completely formed of biodegradable material selected to deteriorate after installation depending on the application. As discussed above, the backing 112 provides structural support to assist in holding the synthetic grass fibers 110 in position during installation.

Detailed Description Paragraph Right (12):

As discussed below, it is important that the backing 112 include openings 116 (FIG. 3B) that allow the roots of natural grass plants planted into the synthetic turf base 104 to pass through the backing. Therefore, in the preferred embodiment the backing is formed of a woven material, an example of which is illustrated. Although woven materials allow roots to grow through the spaces between the individual woven fibers, it may be advantageous to form the backing from materials woven at least partially from biodegradable fibers. Using at least a portion of biodegradable fibers in the formation of the backing would allow such fibers to degrade over time, thus creating larger openings through the backing which the roots could grow.

Detailed Description Paragraph Right (13):

As discussed above, it is also important that the backing support the synthetic grass fibers 110 during installation and also after installation until such time as the fibers become completely supported by a dense growth of natural grass plants within the synthetic turf base. Therefore, in some embodiments it may be advantageous to form the backing from woven fibers having varying degrees of biodegradability. For example, a portion of the fibers can be formed of a material that biodegrades over a first period of time, a second portion of the fibers can be formed of a material that biodegrades over a second period of time, etc. Therefore, the backing 112 may be formed of biodegradable materials that allow a portion of or all of the backing to biodegrade over an extended period of time, thus allowing the synthetic turf base to be fully supported by the growth of the natural grass plants while still allowing the backing

material to biodegrade thus increasing the size and occurrence of openings through the backing material in order to allow for a greater growth of the roots of the natural grass plants through the backing.

Detailed Description Paragraph Right (14):

One example of a biodegradable material for use in this application is urea formaldehyde resin, although those skilled in the art will appreciate that other biodegradable materials could be substituted therefore without departing from the true scope of the subject invention. The backing 112 may be constructed from a variety of materials for positioning the synthetic grass fibers 110 and retaining the synthetic grass fibers in the desired position. As one example, the synthetic grass blades 110 may be tufted to the backing or woven to the backing 112.

Detailed Description Paragraph Right (15):

In order to assist in holding the weft and warp fibers in the backing together and to help hold the synthetic grass blades in place, it is also advantageous to incorporate a fiber fleece into the backing material. The fiber fleece is placed against the underside of the backing matter prior to the tufting of the synthetic grass blades into the backing material. The fiber fleece is then preferably needle punched into the weft and warp fibers of the backing material using a plurality of needles that punch up through the fleece and backing. The needle punching pushes part of the fleece through the weft and warp fibers of the backing thus attaching the fleece and backing together. The synthetic grass blades are then tufted through the fleece and backing. The fleece helps to hold the synthetic grass blades in place creating a "tuft lock" between the synthetic grass blades and the backing. This tuft lock helps to prevent the synthetic grass blades from falling out during transportation or installation of the turf.

Detailed Description Paragraph Right (16):

In the preferred embodiment, the fiber fleece is formed of a cellulosic biodegradable fiber having a weight of approximately one ounce per square meter. The use of a biodegradable fleece allows the fleece to degrade over time thus allowing a more dense growth of the roots of the natural grass blades through the backing over time.

Detailed Description Paragraph Right (18):

As illustrated in FIG. 9, the edge 113 of the backing 112 is cut using a heated cutter that fuses the ends of the individual fibers forming the backing material together along the cut edge. Fusing the ends of the cut fibers of the backing material provides some in-plane rigidity to the woven backing 112. This in-plane stability in turn assists during installation by helping to maintain the edge 113 of the cut backing material 112 in the predetermined cut shape. In addition, fusing the edges 113 of the backing material 112 during cutting helps to prevent the synthetic grass fibers 110 that are tufted or otherwise fastened into the backing 112 from coming loose from the backing during installation. Various equipment can be used to form the fused cut edge 113, including heated cutting knives, laser cutters, etc.

Detailed Description Paragraph Right (19):

As mentioned above, preferably, the synthetic grass fibers 110 are constructed to include a number of blade openings (splits or fibrillations), as will be described by reference to FIGS. 5A and 5B. Therein, a synthetic grass fiber 500 is constructed from a substantially flexible material, for example, polyolefin or polypropylene. However, the flexible material may be constructed from any material commonly used in the art for making synthetic grass fibers. The flexible material is preferably extruded, or formed using any other technique known in the art, to construct a mesh or web-like structure. So constructed, the flexible material comprises a plurality of strands of material 504 positioned and secured to create a web that defines a plurality of openings 508. Those skilled in the art will appreciate that the synthetic grass fibers illustrated in FIG. 5B is referred to in the art as a fibrillated grass fiber. The fibrillated synthetic grass fiber 500 is preferred to further integrate the improved surface 100, as will be described in more detail below.

Detailed Description Paragraph Right (20):

Presently, the invention is contemplated using synthetic grass fibers that are approximately 28 millimeters in length and that have a density of approximately 12 synthetic grass fibers per 10 centimeters for certain applications or uses. However, longer or shorter fibers could be used with greater or lesser density depending on the contemplated use and site conditions. As an example, one alternative embodiment that is presently contemplated uses synthetic grass fibers that are 33 millimeters in length and have a density of 13 synthetic grass fibers per 10 centimeters and another uses synthetic grass fibers that are 15 millimeters in length and have a density of 8-10

synthetic grass fibers per 10 centimeters.

Detailed Description Paragraph Right (21):

Those skilled in the art will recognize that the construction of the synthetic turf base 104 may be further varied without departing from the present inventions. As examples: the synthetic grass blades 110 may be constructed or attached to the backing so that the synthetic grass blades are either "directional" or "nondirectional"; the openings in the synthetic grass blades may be created by twisting several strands or fibers of material to provide a "twisted" synthetic grass blade; the synthetic grass blades can be constructed in a variety of arrangements, e.g., frizzed.

Detailed Description Paragraph Right (22):

Returning to FIG. 1, the synthetic turf base 104 further includes a surface layer of material 118 positioned atop the flexible backing 112. The surface layer of material 118 preferably fills the synthetic turf base 104 from the flexible backing 112 to a point proximate the top portion 114 of the synthetic grass fibers 110. However, after filling the synthetic turf base 104, the surface layer of material 118 may settle slightly so that the top portions 114 of the synthetic grass fibers 110 extend slightly outward beyond the surface layer of material 118.

Detailed Description Paragraph Right (23):

The improved surface 100 further includes natural grass 120 that is planted in the surface layer of material 118. The natural grass 120 includes a multiplicity of grass blades 122 each having a crown 123 (FIG. 1B) and roots 124 associated therewith. The natural grass 120 is planted in the surface layer of material 118 so that the crown 123 is positioned just below the top of the surface layer of material 118, as is known in the art. Preferably, the seed that is planted to grow the natural grass is positioned in the surface layer of material at a point where the crown will be located after the surface is established. Generally, it is desirable to position the crown 123 approximately one quarter of one inch below the top of the surface layer of material 118. However, those skilled in the art will appreciate that the crown 123 may be positioned at varying distances from the top of the surface layer of material depending upon a variety of factors, e.g., the type of natural grass 120 and the composition of the surface layer of material 118.

Detailed Description Paragraph Right (24):

Constructed in this manner, the synthetic grass fibers 110 surround the crowns 123 of the natural grass 120 to provide protection to the crowns 123 which is particularly needed during periods of heavy use and/or poor weather conditions. It will be appreciated by those skilled in the art that in the preferred embodiments of the invention discussed herein, the synthetic grass fibers 110 provide little protection to the grass blades 122. However, it is the intention of the present invention to protect the crown 123 and roots 124 of the natural grass 120 thereby to minimize the time required for the grass blades 122 to re-grow at times when the improved surface 100 is being re-established and to provide a surface with a smoother, grass-like appearance, which may be used during re-establishment. The presence of the natural grass 120 gives the improved surface 100 the comfort, feel, grip, and appearance of a conventional natural turf surface while the presence of the synthetic grass fibers 110 protects the crown 123 and roots 124 to protect the improved surface 100 from deterioration, and the resultant high maintenance costs generally associated with a natural turf surface.

Detailed Description Paragraph Right (25):

Returning to FIGS. 1 and 5, the roots 124 of the natural grass 120 extend downward through the surface layer of material 118, through the blade openings 508 of the synthetic grass blades 110, and through the backing openings 116 of the flexible backing 112. Providing blade openings 508 through which the roots 124 extend permits the roots 124 to assist in integrating the natural grass 120 with the surface layer of material 118 and the synthetic grass fibers 110. Providing backing openings 116 through which the roots 124 can extend permits the roots 124 to assist in integrating the synthetic turf base 104 with the foundation 102. It is desirable, therefore, to provide blade openings 508 and backing openings 116 adequate in size and number to permit the roots 124 to penetrate from the surface layer of material 118 to the sub-base 108.

Detailed Description Paragraph Right (26):

One method of providing blade openings 508 of adequate size and number is to provide synthetic grass fibers 500 with a web 506, as discussed above by reference to FIG. 5B. After the roots 124 have grown through the blade openings 508 of the synthetic grass fibers 500 the roots 124 will assist in maintaining the synthetic grass fibers 500 in position thereby integrating the synthetic turf base 104. Other methods for providing

blade openings of sufficient size and number to permit the roots 124 to integrate the synthetic turf base will be apparent to those skilled in the art.

Detailed Description Paragraph Right (28):

As mentioned briefly above, the sub-base 108 is constructed to provide structural support to the synthetic turf base 104, as with conventional or sand-filled synthetic turf. Unlike conventional or sand-filled synthetic turf, however, the sub-base 108 is further constructed to provide a growing medium for the roots 124 of the natural grass 120.

Detailed Description Paragraph Right (29):

The surface layer of material 118 may comprise any of a variety of materials for supporting the natural grass 120. In the presently preferred embodiment of the invention, the surface layer of material 118 is a mixture of sand and rubber particles. However, it will be apparent to those skilled in the art that the surface layer of material may comprise any of a variety of materials for supporting of and as a growing medium for the natural grass 120. Further, it is desirable to provide the surface layer of material 118 in sufficient quantity to assist in stabilizing the synthetic turf base 104 and the synthetic grass blades 110. Preferably, the surface layer of material 118 is provided in quantity sufficient to provide approximately five pounds for each square foot of the improved surface 100. However, more or less material may be provided in different applications. Also, it is desired to provide the surface layer of material 118 in sufficient quantity to extend from about one half to one inch from the flexible backing 112, to provide a sufficient growing medium for the roots 124 of the natural grass 120 above the flexible backing 112.

Detailed Description Paragraph Right (30):

Along these lines, it is to be noted that due to the improved construction of the synthetic turf base 104 in combination with the natural grass 120, the selection of adequate materials for the surface layer of material 118 is not limited as with presently available sand-filled synthetic turf surfaces. As an example, it is generally accepted that only rounded silica sand, a somewhat scarce and expensive sand, is suited for use with sand-filled synthetic turf surfaces. This is because regular sand is abrasive against the users and the synthetic grass blades, and tends to compact preventing surface drainage and creating a harder surface that is less comfortable for the user. However, due to the tendency of the roots 124 of the natural grass 120 of the present invention to hold the surface layer of material 118 in place, regular sand may be used in the improved surface 100 without increased abrasion against the synthetic grass blades 110. Further, the roots 124 of the natural grass 120 provide some resiliency and movement in the synthetic turf base 104 which reduces compaction. Still further, the grass blades 122 of the natural grass 120 protect the user from abrasion against the surface layer of material 118.

Detailed Description Paragraph Right (31):

Still further, although in some applications it is desirable to mix rubber, or other cushioning particles with the sand, it is generally accepted that rubber particles cannot be mixed with the silica sand (and to some extent also, regular sand) of prior art sand-filled synthetic turf surfaces. This is because water and agitation of the sand will tend to separate the rubber particles from the sand, bringing the rubber particles to the top. However, due to the tendency of the roots 124 of the subject invention to hold the surface layer of material 118 in place, rubber particles may be mixed with the selected surface layer of material 118 to thereby provide a more comfortable playing surface. Also, the addition of rubber particles to the surface layer of material results in less compaction and, therefore, less mechanic aeration of the surface as part of a maintenance program is required.

Detailed Description Paragraph Right (32):

In many applications, it is advantageous that the top portions 114 do not extend beyond the surface layer of material 118 to achieve the same advantages of the subject invention. Such applications include football or soccer, where surfaces with natural characteristics are desired and where exposed top portions 114 that extend significantly beyond the surface layer of material 118 present a hazard to the players. Whether the top portions 114 extend beyond the surface layer of material 118 or not, the crown 123 and roots 124 are protected by the synthetic grass fibers 110. Since the root system of the natural grass 120 is protected by the synthetic grass blades, even when the blades 122 of the natural grass 120 are destroyed during play, they regrow quickly without the maintenance required for fully natural surfaces, i.e., replanting may not be required since the established roots 124 and crown 123 will regenerate new blades 122.

Detailed Description Paragraph Right (33):

Another advantage of the preferred embodiment of the present invention is that the grass blades 122 of the natural grass 120 shield sunlight from the synthetic grass fibers 110 of the synthetic turf base 104 substantially reducing the breakdown of the synthetic grass fibers 110 due to ultraviolet light. Further, the incorporation of the natural grass 120 with the synthetic turf base 104 reduces wear of the synthetic turf base 104 since the roots 124 of the natural grass 120 reduce the grinding action of the sand on the synthetic turf. This reduction in wear and ultraviolet light breakdown increases the expected life of the improved surface 100, thereby reducing the long term cost of the surface.

Detailed Description Paragraph Right (34):

In another embodiment of the invention, the synthetic grass fibers 600 and 602 are constructed from synthetic grass fibers having varying lengths. Referring to FIG. 6, an improved surface 604 is constructed from synthetic grass fibers 600 having a first length and, 602 having a second length secured to a flexible backing 608. As illustrated in FIG. 6, the length of the fibers 600 is greater than the length of the fibers 602 so that the synthetic grass fibers 600 extend outward from the flexible backing 608 a greater distance than the synthetic fibers 602.

Detailed Description Paragraph Right (35):

The alternate improved surface 604 provides improved characteristics for selected applications. As one example, the improved surface 604 is particularly suited for use as the driving portion of a golf tee because the longer synthetic grass fibers 600 provide greater resistance to golf clubs and to support the golf balls above the top of the improved surface 604 thereby decreasing the damage to the remainder of the improved surface 604, and because the longer synthetic grass fibers 600 provide more uniform appearance after being used. As another example, a selected portion of the first portion 600 of synthetic grass fibers may be provided in a predetermined color for marking lines, logos, etc. Those skilled in the art will appreciate that the synthetic grass fibers of the subject invention may be constructed from a variety of lengths to provide different characteristics to the improved surface, and that two or more different lengths could be used in the same application.

Detailed Description Paragraph Right (36):

As noted above, it is sometimes desirable to permit a portion, as described by reference to FIG. 6, of the synthetic grass fibers 110 to extend outward beyond the surface layer of material 118. This can provide additional protection to the crown 123, roots 124, and blades 122 of the natural grass 120, thereby possibly improving the durability of the natural grass. The characteristics of the resulting improved surface 100 can be varied by varying the length and density of the top portions 114 that is to be exposed (see FIG. 6). Further, at times when the grass blades 122 of the natural grass 120 are worn short, exposed portions of the synthetic grass fibers 110 of the synthetic turf base 104 and 604 may help to protect the crown 123, roots 124, and blades 122 and helps provide a visually pleasing surface.

Detailed Description Paragraph Right (37):

Referring to FIG. 2, a description of a method of constructing one embodiment of the improved surface 100 illustrated in FIG. 1 will be described. Initially, the sub-grade 106 is prepared by forming trenches 400 and adding drainage piping 482. Thereafter, the second perforated filter 109 is added atop the sub-grade 106, if desired, and is followed by formation of the sub-base 108. If the first perforated filter 111 is desired, it is placed upon the sub-base 108 followed by the synthetic turf base 104, including the surface layer of material 118. It should be noted by those skilled in the art that the filters 109 and 111 are optional and one or the other or both may not be used depending upon the application. After the synthetic turf base 104 has been installed, the natural grass 120 (FIG. 1A) is planted so that the crown 123 and roots 124 can form, as described above.

Detailed Description Paragraph Right (38):

One advantageous way of installing the improved surface 100 is to use preseeded panels. In accordance with this method, the synthetic turf base is manufactured in panels of a size readily stored, transported, and installed, e.g., of approximately 16 inches by 48 inches. During manufacturing, the synthetic turf base is filled with a surface layer of material which is seeded to create a seeded panel.

Detailed Description Paragraph Right (43):

As illustrated in FIG. 7, it is desirable to reinforce the edges of the panels 198 or

synthetic turf base 104 as they are installed. In the embodiment illustrated in FIGS. 7A and 7B, the edges between the various panels 198 are reinforced by first applying a mesh-type material 200 upon the foundation prior to placing the panels 198. Also as illustrated in FIGS. 7A and 7B, the mesh material is provided in an L shape such that the mesh-type materials fit together so that the mesh-type material 200 underlies all of the edges of the adjoining panels 198. The mesh-type material 200 is provided so that the roots of the natural grass plants grow through the panels 198 and down through the mesh-type material 200 and into the underlying foundation. Thus, the roots of the natural grass plants interlock the edges of the panels 198 with the mesh-type material 200 and the underlying foundation. The interlocking of the panels, mesh-type material 200, and foundation help to ensure that the edges of the panels 198 are efficient and reliably joined together thus preventing possible movement of one panel with respect to another or possible lifting of the edges of the panels.

Detailed Description Paragraph Right (45):

The mesh-type material 200 illustrated in FIGS. 8A and 8B is installed underneath the edges of the two adjoining synthetic turf base pieces 104. In order to further ensure that the edges of the synthetic turf base pieces do not shift or become otherwise displaced during completion of the installation, it is desirable to anchor the edges of the synthetic turf base pieces and mesh-type material 200. In the embodiment illustrated in FIGS. 8A and 8B, U-shaped anchors 203 are inserted into the installed synthetic turf base 104 such that the opposing points of the U-shaped anchors extend through the opposing edges of the synthetic turf base pieces, through the mesh-type material 200 and into the underlying foundation. The U-shaped anchors 203 are left in position during the subsequent filling of the synthetic turf base with a growth medium and removed prior to seeding.

Detailed Description Paragraph Right (46):

Another embodiment of a mesh-type material 204 is illustrated in FIGS. 11 and 12. The mesh-type material 204 illustrated in FIGS. 11 and 12 is fabricated from a rubber, plastic, or other material. The mesh-type material 204 includes a plurality of spikes or other protrusions 206 that extend either upward from the upper surface of the material, downward from the lower surface of the material, or both upper and downward from the upper and lower surfaces of the material, respectively, depending on the application. The area between the protrusions 206 is left open to allow the roots of the natural grass plants to grow through the mesh-type material 204 as discussed above.

Detailed Description Paragraph Right (47):

As illustrated in FIG. 11, when installed, the protrusions 206 extend downward into the foundation and upward through the backing material 112 of the synthetic turf base 104. The protrusions 206 thus help to anchor the mesh-type material 204 in the proper position on the foundation and also help the mesh-type material 204 to engage and stabilize the edges of the synthetic turf base 104. The embodiment illustrated in FIGS. 11 and 12 may provide additional stability to the installation during subsequent filling of the synthetic turf base 104 with growth medium and seeding. In addition, the embodiment of the mesh-type material 204 may also help to eliminate the need for the use of the U-shaped anchors 203 discussed above.

Detailed Description Paragraph Right (48):

As discussed briefly in the background section, one of the problems associated with prior playing surfaces used for football, soccer, and some other sports is the application of boundary indicators such as boundary lines and yardage lines. FIG. 10 illustrates an embodiment of the invention that incorporates built-in boundary indicators that help to eliminate the problems associated with prior boundary indicators. As illustrated and discussed above, the synthetic turf base 104 includes a porous backing 112 and a plurality of upwardly extending synthetic grass fibers 110. In the embodiment illustrated in FIG. 10, the synthetic turf base 104 includes an indicator portion 212 that is configured to provide boundary indications, line indications, etc. In the preferred embodiment, the indicator portion 212 is formed by forming a portion of the synthetic turf base 104 without any synthetic turf fibers 110. The indicator portion 212 is then formed separately by tufting synthetic fibers 214 into a backing material 216.

Detailed Description Paragraph Right (49):

Unlike the synthetic turf base 104, it is advantageous to form the backing material 216 from a material that is impervious to the root growth of natural grass plants to help prevent grass from growing into the indicator portion. It is also advantageous to form the synthetic grass fibers 214 of a sufficient length that they extend upward from the

surface of the backing material 112 such that the tops of the fibers 214 are at approximately the same height as the top of the mowed natural grass blades 120 growing in the synthetic turf base 104.

Detailed Description Paragraph Right (50):

In some applications, it is also advantageous to form the indicator portion 212 with a much more dense distribution of synthetic grass fibers 214 than that used in the surrounding synthetic turf base 104. Forming the indicator portion 212 with a sufficiently dense distribution of synthetic grass fibers 214 helps to prevent the natural grass from growing into or otherwise becoming part of the indicator portion 212. It is also advantageous to form the backing material 216 with a type of herbicide included in the backing material to prevent natural grass from growing into the indicator portion 212. It is further advantageous to form the imitation fibers 214 of a color that contrasts with the natural color of the grass thus allowing the indicator portion 212 to be easily observed by players and onlookers.

Detailed Description Paragraph Right (51):

The indicator portion 212 may be attached to the backing material 112 by applying an adhesive between the backing material 216 and the backing material 112. Alternatively, the indicator portion 212 may be sewn or otherwise attached to the backing material 112. In yet other embodiments, the synthetic fibers 214 may be tufted directly into the backing material 112. However, in such applications it is advantageous that the backing material 112 in the region of the indicator portion 212 be coated with an impervious material either before or after the tufting of the imitation fibers 214 to prevent grass growth through the backing in the region of the indicator portion 212.

Detailed Description Paragraph Right (52):

In addition to forming boundary lines, etc., as described above, graphical indicators such as high school or college logos, names, etc., may also be formed in the artificial turf base 104 in a manner similar to that described above with respect to the indicator portion 212.

Other Reference Publication (1):

Notts Sport, "Notts Sport Grass Reinforcement Passes Tough Scottish Trials," Notts Sport News, Grass Reinforcement Ed., 2 pgs. (1990).

Other Reference Publication (2):

Notts Sport, "Stonehenge Trials Lead to More Orders," Notts Sport News, Grass Reinforcement Ed., 2 pgs. (1990).

Other Reference Publication (3):

Notts Sport, "Children at Play--The Next Four Years," Notts Sport News, Child's Play Ed., 2 pgs..

Other Reference Publication (4):

Safety Play Systems Inc., "Keep Off--Your Feet Are Killing Me!" Notts Sport News, Golf Ed., 2 pgs.

Other Reference Publication (8):

"The Tried and Tested Sand-Filled Artificial Turf," DLW Sportfloor, date unknown.

Other Reference Publication (9):

"Sand-Filled Artificial Turf--We Take Nature as our Model," DLW Sportfloor, date unknown.

Other Reference Publication (13):

"Grass Finally Grows at Rice Stadium," The Salt Lake Tribune, Aug. 28, 1995 (p. D-1, 6).

Other Reference Publication (14):

"The Green Grass of Gridirons Begins to Make a Comeback," The New York Times, Sep. 3, 1995 (pp. 1, 24).

CLAIMS:

1. A playing surface comprising:

(a) a foundation;

(b) a synthetic grass turf located on top of the foundation and including a backing material and a plurality of synthetic grass fibers extending generally vertically upward from the backing material, the synthetic grass fibers being formed of at least a first group of fibers having a first length and a second group of fibers having a second length longer than the first length so that the second group of fibers extends upward from the backing material a greater distance than the first group of fibers;

(c) a layer of growth medium disposed in the synthetic grass turf to a depth sufficient to substantially fill the synthetic grass turf to the top of the first group of fibers; and

(d) natural grass plants, having grass blades, crowns and roots disposed in the growth medium, the roots extending downward through the growth medium, the backing material, and into the foundation, the crowns being located slightly below the top of the first group of fibers and the grass blades extending upwardly above the top of the first group of fibers and slightly above, the second group of fibers.

2. The playing surface of claim 1, wherein the first group of fibers and second group of fibers are approximately uniformly distributed throughout the synthetic grass turf.

3. The playing surface of claim 1, wherein the second group of fibers is formed of a material having a color that contrasts with a color of the natural grass plants.

6. The playing surface of claim 1, wherein the second group of fibers are attached to a second backing material that is in turn attached to the backing material of the synthetic grass turf.

7. The playing surface of claim 1, wherein the backing material in the region of the second group of fibers incorporates a herbicide that helps prevent the natural grass plants from growing into the region of the second group of fibers.

10. A method of forming a playing surface comprising:

(a) forming a foundation;

(b) placing more than one piece of synthetic grass turf on the foundation, the synthetic grass turf having a plurality of synthetic grass fibers extending generally vertically upward from a backing material;

(c) placing a porous mesh material on the foundation between the foundation and the backing material of said synthetic grass turf so that the mesh material underlies adjoining edges of said pieces of synthetic grass turf;

(d) filling the synthetic grass turf with a growth medium so that a top of the growth medium is approximately at the same height as a top of the synthetic grass fibers; and

(e) sowing natural grass on top of the growth medium so that roots of the natural grass plants extend downward through the synthetic grass turf, through the mesh material, and into the foundation and so that blades of the natural grass plants extend upward from a top of the growth medium to form a playing surface of natural grass.

13. The method of claim 10, further comprising forming the synthetic grass turf of a plurality of synthetic grass fibers extending generally vertically upward from the backing material such that the synthetic grass fibers in one or more portions of the synthetic grass turf are longer and extend generally vertically upward from the backing material farther than the synthetic grass fibers in the rest of the synthetic grass turf so that the longer synthetic grass fibers form a visual indicator and wherein the filling step comprises filling the synthetic grass turf with a growth medium so that the top of the growth medium is approximately at the same height as the top of the shorter synthetic grass fibers.

14. The method of claim 10, further comprising forming the backing material from a woven material and wherein the edges of individual strands of the woven material are fused together at one or more edges of each piece of synthetic grass turf to provide some in-plane stability to the backing material.

15. A playing surface comprising:

(a) a foundation;

(b) a plurality of pieces of synthetic grass turf located on top of the foundation so that the edges of the pieces of synthetic turf are placed adjacent each other to form a continuous surface of synthetic grass turf, the synthetic grass turf including a backing material and a plurality of synthetic grass fibers extending generally vertically upward from the backing material;

(c) a porous mesh material located between the foundation and the synthetic grass turf in the region of the edges of the synthetic grass turf so that the mesh material underlies the adjoining edges of the pieces of synthetic grass turf;

(d) a layer of growth medium disposed in the synthetic grass turf to a depth sufficient to substantially fill the synthetic grass turf to the top of the synthetic grass fibers; and

(e) natural grass, including blades and roots, planted in said growth medium so that the roots extend downward through the growth medium, the backing material, and into the foundation and so that the blades extend upward from the top of the layer of growth medium to form a playing surface.

16. The playing surface of claim 15, further comprising boundary indicators, the boundary indicators being formed of synthetic grass fibers extending generally vertically upward from the backing material above a top of the layer of growth medium a sufficient distance so that the tops of the synthetic grass fibers forming the indicators form a visual indicator within the natural grass.

17. The playing surface of claim 16, wherein the artificial grass fibers forming the indicators are of a color that contrasts with a color of the natural grass.

20. A playing surface comprising:

(a) a foundation;

(b) a synthetic grass turf located on top of the foundation and including a backing material, a fleece material, and a plurality of synthetic grass fibers, the fleece material being located on the underside of the backing material and being attached to the underside of the backing material, the synthetic grass fibers extending through the backing material and the fleece material and extending generally vertically upward from the backing material in approximately the same direction;

(c) a layer of growth medium disposed in the synthetic grass turf to a depth sufficient to approximately fill the synthetic grass turf to a top of the synthetic grass fibers; and

(d) natural grass plants, having grass blades, crowns, and roots disposed in the growth medium, the roots extending downward through the growth medium, the backing material, the fleece material, and into the foundation, the crowns being located at or slightly below the top of the synthetic grass fibers and the grass blades extending upward above the top of the synthetic grass fibers to form a natural grass playing surface.

21. The playing surface of claim 20, wherein the synthetic grass turf includes synthetic grass fibers formed of at least a first group of fibers having a first length and a second group of fibers having a second length longer than the first length so that the second group of fibers extends upward from the backing material a greater distance than the first group of fibers and so that the layer of growth medium is disposed in the synthetic grass turf to a depth sufficient to approximately fill the synthetic grass turf to the top of the first group of fibers and so that the crowns of the natural grass plants are located at or slightly below the top of the first group of fibers and the grass blades extend upward above the top of the first group of fibers and slightly above the top of the second group of fibers.

22. The playing surface of claim 21, wherein the first group of fibers and second group of fibers are approximately uniformly distributed throughout the synthetic grass turf.

23. The playing surface of claim 21, wherein the second group of fibers is grouped together in a prespecified path to form a visual indicator and wherein the second group of fibers is formed of a material having a color that contrasts with the color of the natural grass plants.

24. A grass playing surface comprising:

(a) a foundation,

(b) an artificial grass turf located on top of the foundation, the artificial grass turf having generally vertically upright fibers mounted in a porous backing material;

(c) a layer of growth medium disposed in the artificial grass turf to a depth at least approaching the top of the fibers of the artificial grass turf; and

(d) natural grass plants having grass blades, crowns and roots, the grass plants disposed in the growth medium, the roots extending downwardly through the growth medium, the artificial grass turf, and into the foundation, the crowns being located slightly below the top of the artificial fibers and the grass blades extending upwardly above the top of the fibers forming a playing surface of substantially natural grass.

25. A grass playing surface comprising:

(a) a foundation;

(b) an artificial grass turf located on top of the foundation, the artificial grass turf having generally vertically upright fibers mounted in a porous backing material, the fibers having at least one free end and extending upward in the same general direction;

(c) a layer of growth medium disposed in the artificial grass turf to a depth at least approaching the top of the fibers of the artificial grass turf; and

(d) natural grass plants having grass blades, crowns and roots, disposed in the growth medium, the roots extending downwardly through the growth medium, the artificial grass turf and into the foundation, the blades extending upwardly above the top of the fibers forming a playing surface of substantially natural grass.

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File: USPT

Jul 5, 1994

DOCUMENT-IDENTIFIER: US 5326192 A

TITLE: Methods for improving appearance and performance characteristics of turf surfaces

Brief Summary Paragraph Right (1):

The present invention relates to turf surfaces including lawns and turfed surfaces for sporting events such as football, baseball, soccer, and polo fields, golf courses and the like. Methods are provided which involve the application of fibers to either the bare (non-grassed) areas or grassy areas. The fibers are then worked into the soil or turf. The treated area also gains improved performance characteristics and the worked in fibers aid and protect the development of new as well as existing grass roots which, in turn, further facilitates the improvements. One result is that the appearance of the area is improved, particularly when colored fibers are employed.

Brief Summary Paragraph Right (6):

U.S. Pat. No. 4,421,439 is directed toward woven fabric, comprising filaments such as polyester, polyamides and polyolefins. The fabric is positioned beneath sand, gravel, stones, clay, loam and the like at a depth of at least 10 cm. The invention is based on the particular construction of the fabric which gives it improved load bearing performance.

Brief Summary Paragraph Right (10):

U.S. Pat. No. 4,819,933, similarly discloses the use of a mixture comprising sand and individual strands of synthetic fibers to produce a relatively soft, non-grassed, playing surface for equestrian and sports events.

Brief Summary Paragraph Right (14):

It is another object of the present invention to improve the appearance of non-grassed areas within a normally turfed surface by punching grass colored textile fibers into the soil, leaving a portion of the fibers exposed above the surface to simulate grass blades.

Brief Summary Paragraph Right (15):

It is yet another object of the present invention to provide a method which anchors newly sown grass roots that have been placed to remediate worn or barren areas of turfed surfaces.

Detailed Description Paragraph Right (1):

As noted hereinabove, practice of the present invention is based upon the addition of various discrete fiber materials into areas that contain turf, e.g., grass, or in which turf can be grown, such as barren land. As is known, turf grasses are grown in soil, the basic types of mineral soils being gravel, sand, silt and clay. Mixtures thereof give rise to coarse-grained soils, more than 50 percent retained on a No. 200 sieve, and fine-grained soil, 50 percent or more passes through a No. 200 sieve. No attempt shall be made to discuss the variations in soil types. Those skilled in the art are familiar with and can refer to the United Soil Classification System published as ASTM Standard D2487. With reference thereto, soils with which the invention can be practiced include gravel, sand, silt and clay. The term "area" employed herein is intended to refer to all types of soil media in which turf is grown, and likewise can be improved or, in which turf can or will be grown.

Detailed Description Paragraph Right (4):

Preferred materials include the olefins, particularly polypropylene, polyesters, nylons, acrylics, and the like but should not be limited to these. Practical considerations include creep resistance, a strong trait of polyesters, and dispersibility of the fiber material in the soil, although the absence of either one of

these properties should not eliminate a particular polymer. Typically, man-made fibers having specific gravities ranging from about 0.80 to 2.36.

Detailed Description Paragraph Right (19):

If grass seed has been placed with the fibers, it should come to term before the area is disturbed by mowing. Should the fibers be used by themselves, fiber length should be a consideration so as not to interfere with post-addition field or lawnscaping mowing.

Detailed Description Paragraph Right (20):

If fiber "dusting" is not a problem, isolated small spots on a playing field and the like may be cosmetically remediated using 0.25 inch (0.635 cm) grass colored fibers. To do so, the fibers can be merely hand broadcast over the barren spot surface or fibers can be mixed with some soil medium such as sand and placed onto or in the distressed area.

Detailed Description Paragraph Right (22):

With reference to the drawings, practice of the present invention is depicted schematically. FIGS. 1A-1E can be employed to illustrate and describe application of the method to existing turf. FIG. 1A presents soil 10, having an exposed surface 11, turf e.g., grass 12 above the surface and roots 13 below the surface. In FIG. 1B the turf 12 has been worn away, such as by heavy activity on the surface 11. Next, fibers 14 are applied to the soil via apparatus, indicated schematically by the numeral 15, and worked in by means (not shown, but discussed herein) as depicted in FIG. 1C. Some of the fibers become subsequently worked into the soil below the surface and around the roots 13 while some may be allowed to remain on the surface 11, as depicted in FIG. 1D. It is to be understood that alternatively, the apparatus 15 can apply a composite or mixture of fibers 14 and soil or a soil component, such as sand, or a mixture of sand and peat, or the like also as discussed herein. Grass seed, (not shown) may also be present. During the step of working, the surface 11 can also be levelled or otherwise shaped as desired.

Detailed Description Paragraph Right (36):

With respect to hardness, Gmax increased for all treatment when the number of hammer drops increased from one to three. Canaway (1990) proposed standards for hardness (20 to 80 g preferred and 10 to 100 g acceptable) based on a survey of players and Clegg impact measurements with a 0.5 kg hammer. All treatments, including the sand only control, measured with the 0.5 kg hammer exceeded the limits proposed by Canaway. This indicates that under moist and compacted conditions without grass cover, sand only or sand stabilized with synthetic fibers could exceed the proposed desirable level of hardness proposed by Canaway. The fibers did not increase the hardness of the rootzone mix compared to the sand only control.

Detailed Description Paragraph Right (41):

Within seven days, the germinated seed was developing nicely. Two days later the grass was cut and the next game was played on the tenth day after repair was initiated. Throughout the season, the field appeared green and uniform. Traction was good on the remediated center field. Treatment during the period comprised the working in of colored fibers weekly directly over the grass.

Detailed Description Paragraph Right (42):

Subsequent treatments were essentially the same regarding hydraulic placement of seed and fiber until the weather and lower temperatures no longer permitted seed germination. At this time top dressing and punching in the fibers replaced grass in the barren areas. As a result, fibers were punched into the root zone continually while some remained on the surface as well, thus fulfilling the dual objectives of root reinforcement and cosmetic surface treatment.

Detailed Description Paragraph Type 1 (1):

(1) Hydroseeding, which generally applies seed, mulch materials and water to a soil surface for the encouragement of new grass growth. Textile fibers can be introduced in this manner, with the above constituents, or separately with water only.

Detailed Description Paragraph Type 1 (5):

(5) Pre-mixing into partially grown grass sod, wherein the green fibers provide color and strength to the immature sod that is placed onto the distressed areas.

Detailed Description Paragraph Table (1):

TABLE I	HARDNESS, TRACTION AND SOIL MOISTURE
RESULTS ON NON-GRASS PLOTS	Hardness 0.5 kg Soil

Traction 1 drop 3 drops Moisture Torque Torvane _____
Treatment 690.14 20195.62 7.40 26.98 0.41 mean square
_____ Gmax Percent ft. lb. kg/cm.sup.2
Plot 5 144.20 429.60 3.71 13.66 0.17 (control)
Plot 3 115.60 292.20 8.46 19.33 0.31 (Fib 0.3 percent) Plot 1 129.60 272.20 6.87 21.50
0.30 (Fib 0.5 percent) Plot 4 125.80 365.80 8.27 17.67 0.25 (Mon 0.3 percent) Plot 2
141.60 313.00 7.47 20.00 0.23 (Mon 0.2 percent) _____

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Jun 27, 1972

DOCUMENT-IDENTIFIER: US 3673056 A
TITLE: TURF-LIKE PRODUCT AND METHOD OF MAKING IT

Abstract Paragraph Left (1):

A product having a turf-like appearance and useful as a playing field surface for football, baseball, or other games can be made in a wide variety of blade patterns and textures by (a) providing a liquid layer of polymeric matrix material (e.g., a foamable polyurethane composition) which can be solidified in situ to a desired degree of resilience and toughness; (b) providing a number of flexible polymeric ribbons; (c) making numerous width-wise cuts in one edge of each ribbon so as to form numerous blades (grass-blade-like elements) which are fastened together at their base; (d) forming a composite structure in which the ribbons are closely-spaced and in embedded relation with the liquid matrix layer whereby each ribbon has its length parallel with the matrix layer, its width perpendicular thereto, its blades upstanding therefrom, and a lower portion embedded therein; and (e) causing the matrix layer to solidify in situ.

Brief Summary Paragraph Type 1 (3):

C. forming one edge of each of said ribbons into numerous closely-spaced grass-blade-like elements which are fastened together at their base by providing numerous width-wise cuts of predetermined length along said edge and leaving a portion of the ribbon uncut at the base of said elements,

Brief Summary Paragraph Type 1 (4):

D. placing said ribbons in closely-spaced relation with each other and in embedded relation with said liquid matrix layer so that each of said ribbons has its length substantially parallel with the matrix layer, its width substantially perpendicular to the matrix layer, its grass-blade-like elements upstanding from the matrix layer, and a lower portion embedded in the matrix layer, and

Brief Summary Paragraph Type 2 (2):

2. having as an uppermost portion numerous closely-spaced grass-blade-like elements upstanding from (A) and fastened together at their base, and

Drawing Description Paragraph Right (4):

FIG. 3 shows a side view of a polymeric ribbon resting on its lower edge and having an upper portion which has been formed into numerous grass-blade-like elements.

Detailed Description Paragraph Right (2):

The matrix material used in Step (a) can be any known liquid polymeric composition which is capable of being solidified in situ to form a solidified matrix layer having the properties needed according to particular use intended for the product. A matrix material is used which does not undergo any harmful reaction with the ribbon components during Steps (d) and (e), and which is low enough in viscosity to undergo a suitable rate of flow into the spaces between the ribbons.

Detailed Description Paragraph Right (4):

In some of the most useful embodiments of the invention, the solidified matrix layer of the product (component A) is a flexible and resilient sheet of "nonfibrous" polymeric material; this means that the polymeric material does not have a predominantly fibrous structure as in the case of a fabric or paper, although it can contain a fibrous filler or reinforcement, and it can have a reinforcing fabric or any other useful material in attached or embedded relation with it.

Detailed Description Paragraph Right (7):

One skilled in the art, in view of the present disclosure, will be able to select

suitable polymeric materials for the preparation of matrix component (A) and ribbon component (B) according to the properties needed and the conditions under which the product is to be used. Among the most useful polymers for both components are polyurethane elastomers, neoprene, ethylene/propylene/diene elastomers, chlorosulfonated polyethylene, butadiene/styrene elastomers, natural rubber, polyamides, polypropylene, and plasticized polyvinylchloride and the like. The polymeric material used to form either component can contain one or more of such known additives as pore-forming agents, coloring agents, curing agents, fillers, fireproofing agents, inhibitors, fungicides, and plasticizers.

Detailed Description Paragraph Right (9):

In Step (b), flexible polymeric ribbons are provided which have the desired dimensions, toughness, weather resistance and other properties according to the intended use of the turf-like product. Also, of course, the ribbons (component B of the product) are made of a material which will not undergo any harmful reaction with the matrix material either during or after Steps (d) and (e). The use of a single ribbon as component (B) is also within the spirit of the invention since there is still obtained a product having numerous closely-spaced ribbon components along its surface when a single ribbon is used in Step (d) by such procedures as by wrapping the ribbon back and forth over a series of holding pins fastened outside the matrix area or by mounting the ribbon spirally in a suitable holding means fastened above the area to be filled with the matrix.

Detailed Description Paragraph Right (11):

In Step (c) of the process (see FIG. 3 of the drawings), numerous width-wise cuts 10 of predetermined length are made in the ribbon along its upper edge so that numerous grass-blade-like elements (blades 12) are formed which are fastened together at their base, the cuts terminating in an uncut portion 11 of the ribbon. A blade length of about 0.2-1.5 inches is usually preferred. The blades can be uniform or nonuniform in height, width, thickness, shape, color, or other characteristics. In the modification of FIG. 3 shown in FIG. 4 of the drawings there is an illustration of blades 12 of various size and shape formed by cuts 10 which terminate at base portion 11; all or part of the blades in all or part of the ribbons in a given product can have any one of these designs or any other design considered suitable.

Detailed Description Paragraph Right (12):

By having the blades vary in any particular appearance characteristic along the length or width of the product, it is possible to enhance the attractiveness or the random appearance of the product. The blade-forming cuts can be made rapidly and economically by using cutting machines and techniques well known in the art of cutting predetermined shapes in various kinds of ribbons, tapes, and the like. In one machine, an oscillating cutting blade strikes the ribbon as it rests on an anvil while the ribbon is moved along like in a sewing machine. The Step (c) cutting operation can be completed prior to Step (d); or incomplete cuts can be made prior to Step (d) which are easily broken open after Step (e), for example, by means of wire buffing wheels. Also, Step (c) can be carried out after Step (e) by subjecting the surface of the composite structure to suitable cutting means such as cutting wheels or sharp knives.

Detailed Description Paragraph Right (16):

Synthetic turf products are obtainable according to the present invention having an attractive and durable lawn-like appearance and having beneficial utility as a surface material for areas on which sports events such as ball games or other activities are performed. The product can be made in any one of numerous predetermined patterns and textures, and degrees of resilience or toughness or other characteristics. The present process is also useful for the manufacture of such products as buffing wheels, carpets for use outside or inside, and surfaces for golf-practicing areas in which different areas have different predetermined ball-slowing characteristics.

Detailed Description Paragraph Right (19):

Two different batches of ribbons are prepared. First, a number of flexible polymeric ribbons are prepared having the appearance shown in FIG. 3 of the drawings. The ribbons are made of a tough weather-resistant elastomer material (described below) having a grass-like green color; they have a thickness of 15 mils (0.015 inch), a width of 11/4 inch, and a length of 12 inches.

Detailed Description Paragraph Right (20):

Using a cutting apparatus equipped with a series of knife-like cutting dies, numerous width-wise cuts 10 are made in each ribbon along its upper edge so that numerous grass-blade-like elements or blades 12 are formed which are fastened together at their

Detailed Description Paragraph Right (22):

Detailed Description Paragraph Right (30):

Detailed Description Paragraph Table (1):

64/32/4	930	2	Terpolymer	72/24.5/3.5	248	3	Chlorosulfonated polyethylene	62	4	Stearic acid	12.4	5	Zinc oxide	62	6	Silica	1240	7	Oil	37.2	8	Polyethylene	248	9	Green pigment	37.2	10	2-mercaptobenzothiazyl disulfide	12.4	11	Tetramethylthiuram disulfide	8.68	12	Zinc di-n-butyl dithiocarbamate	24.8	13	Sulfur	24.8
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1. A process for preparing a product having a turf-like appearance which comprises
 - a. providing a liquid layer of polymeric matrix material which is capable of being solidified in situ,
 - b. providing a number of flexible polymeric ribbons,
 - c. forming one edge of each of said ribbons into numerous closely-spaced grass-blade-like elements which are fastened together at their base by providing numerous width-wise cuts of predetermined length along said edge and leaving a portion of the ribbons uncut at the base of said elements,
 - d. placing said ribbons in closely-spaced relation with each other and in embedded relation with said liquid matrix layer so that each of said ribbons has its length substantially parallel with the matrix layer, its width substantially perpendicular to the matrix layer, its grass-blade-like elements upstanding from the matrix layer, and a lower portion embedded in the matrix layer, and
 - e. causing the matrix layer to solidify in situ.
2. A product having a turf-like appearance and comprised of
 - A. an in situ solidified matrix layer of polymeric material and
 - B. numerous closely-spaced flexible polymeric blade-containing ribbons in embedded attachment with (A) and providing the upper surface of the product with a lawn-like appearance, each of said ribbons

- 1. having its length substantially parallel with (A) and its width substantially perpendicular to (A),
 - 2. having as an uppermost portion numerous closely-spaced grass-blade like elements upstanding from (A) and fastened together at their base as the result of providing numerous width-wise cuts of predetermined length along one edge of the ribbons and leaving a portion of the ribbons uncut at the base of the elements, and
 - 3. having the lower base portion in embedded attachment with (A).
10. A product according to claim 9 wherein said grass-blade-like elements have a length of about 0.2-1.5 inches.

Set Name Query

side by side

Hit Count Set Name

result set

DB=USPT; PLUR=YES; OP=OR

<u>L18</u>	l11 and l17	22	<u>L18</u>
<u>L17</u>	ribbon or ribbons	51122	<u>L17</u>
<u>L16</u>	l3 and l15	221	<u>L16</u>
<u>L15</u>	l10 and l14	752	<u>L15</u>
<u>L14</u>	l12 and l13	16703	<u>L14</u>
<u>L13</u>	synthetic adj grass or grass	24202	<u>L13</u>
<u>L12</u>	infil or particula\$2 or granular or filler	1663189	<u>L12</u>
<u>L11</u>	l9 and l10	250	<u>L11</u>
<u>L10</u>	sport	32379	<u>L10</u>
<u>L9</u>	l3 and l8	4545	<u>L9</u>
<u>L8</u>	l6 and l7	18622	<u>L8</u>
<u>L7</u>	filiform or particula\$2 or granular or fill\$3	1865450	<u>L7</u>
<u>L6</u>	artificial adj turf or artificial adj grass or grass	24471	<u>L6</u>
<u>L5</u>	l2 and l3	2	<u>L5</u>
<u>L4</u>	l1 and l3	0	<u>L4</u>
<u>L3</u>	polyolefin or polyethylene or pvc	308040	<u>L3</u>
<u>L2</u>	5958527.uref.	3	<u>L2</u>
<u>L1</u>	5958527.PN.	1	<u>L1</u>

END OF SEARCH HISTORY